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Title:	Joint DoD/DOE Munitions Program
Author(s):	Mason, Thomas A
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# Joint DoD/DOE Munitions Program

**Thomas A. Mason**

**JMP Program Manager  
Office of the Associate Director for Weapons Physics**



# Basics of the Joint DoD/DOE Munitions Program

- The JMP was established by an MOU between DOE and DoD in 1985.
- Level of effort, long-term research program to address areas of mutual interest. (Particularly, non-nuclear technology)
- The JMP is one of three related programs administered by Jose Gonzalez in the Land Warfare and Munitions Office, AT&L. The other two programs are the Joint Fuze and Joint Insensitive Munitions Technology Programs.
- Oversight is provided by a Technical Advisory Committee (TAC) that is comprised of DoD Laboratory Directors, PMs, PEOs, and senior staff.
- In FY13, the JMP is a \$40M program shared equally between Los Alamos, Lawrence Livermore and Sandia National Laboratories.
- Each DOE/NNSA weapons laboratory is responsible for identifying the appropriate local matching funds according to their individual needs and mission space.

## *Identified core competencies*

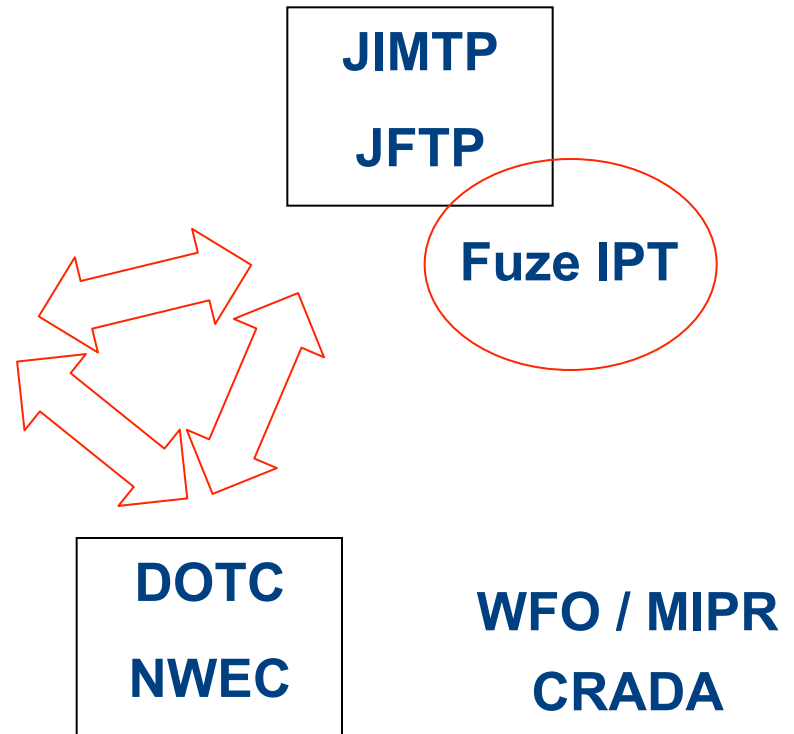


# Joint DoD/DOE Munitions Program

JMP topics fall under the following broad headings;

- Modeling & Simulation (M&S)
- Energetic Materials (EM)
- Initiation, Fuzing & Sensors (IFS)
- Warheads & Penetrators (W&P)
- Munitions Lifecycle (ML)

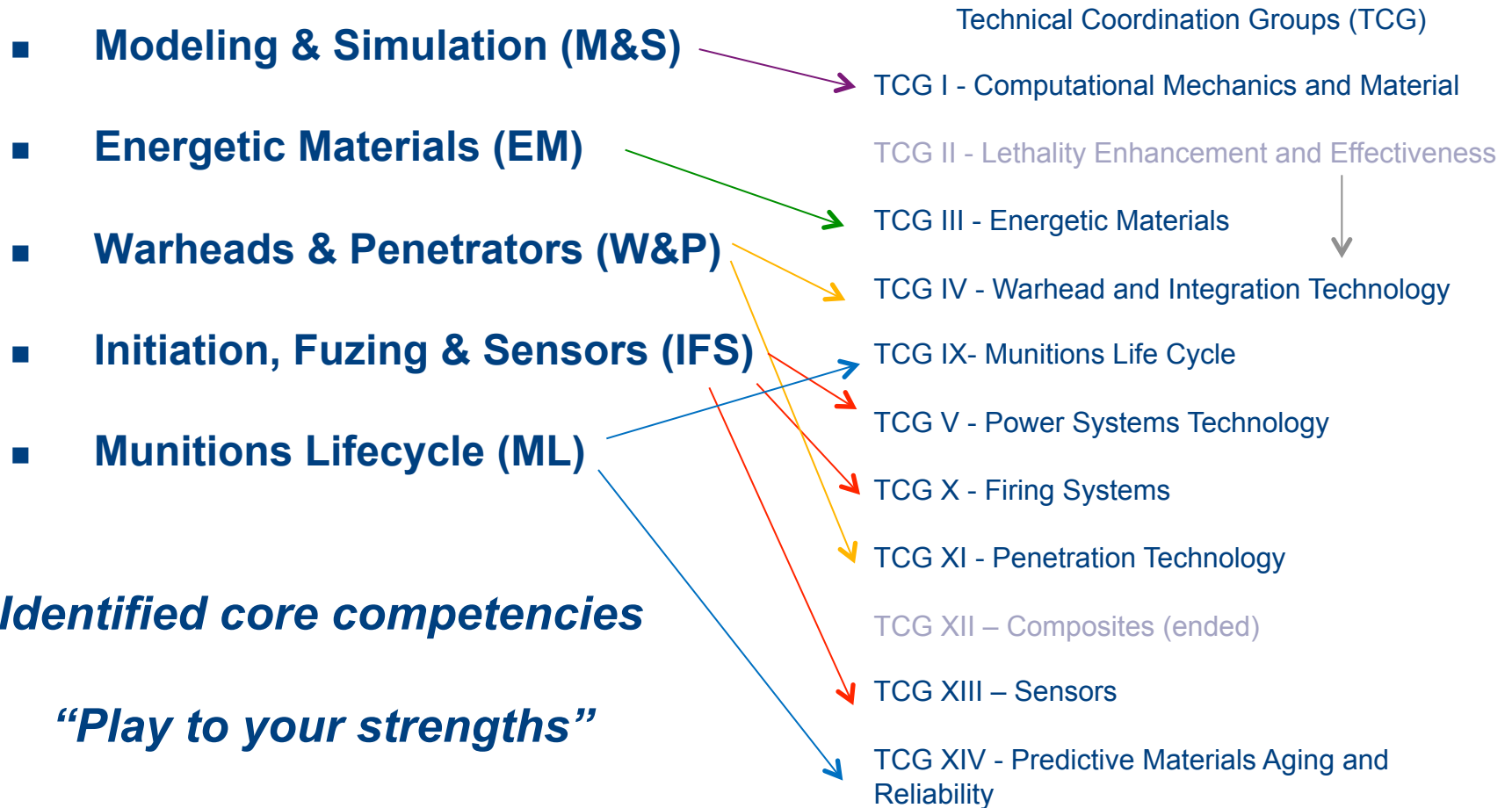
**TATB**  
**Interaction Detonator**  
**Fuzable plugs**





# Details of the Joint DoD/DOE Munitions Program

JMP topics fall under the following broad headings;





# Return on Investment

~\$20M DoD 'funds in' under the JMP ( ~\$6.7M per laboratory)

Very strong leveraging of DoD needs against NNSA needs, requirements and 'desirements'

**Practicing *real* scope match**

Historic perspective: LLNL and SNL put forth numerical tools (ASC)

– LANL is responsible for developing the ideas ( models, methods, data)...

**Where does the NNSA match at Los Alamos come from?**

**Science Campaigns (C1-C4)**

**Engineering Campaigns (C5-C8)**

**Advanced Certification (ACC)**

**Advanced Simulation and Computing (ASC)**



# JMP Program at LANL: Recent Highlights

**K26 EFP Report – LANL / ARDEC / AFRL Eglin / Dyna East**

**Proliferation of advanced diagnostics across JMP community**

- PDV, PIV, High-speed Schlieren, CW x-ray imaging

**Characterization capability for warhead and structural materials**

- Rate and temperature dependent models
- Proliferation of test capability within the complex

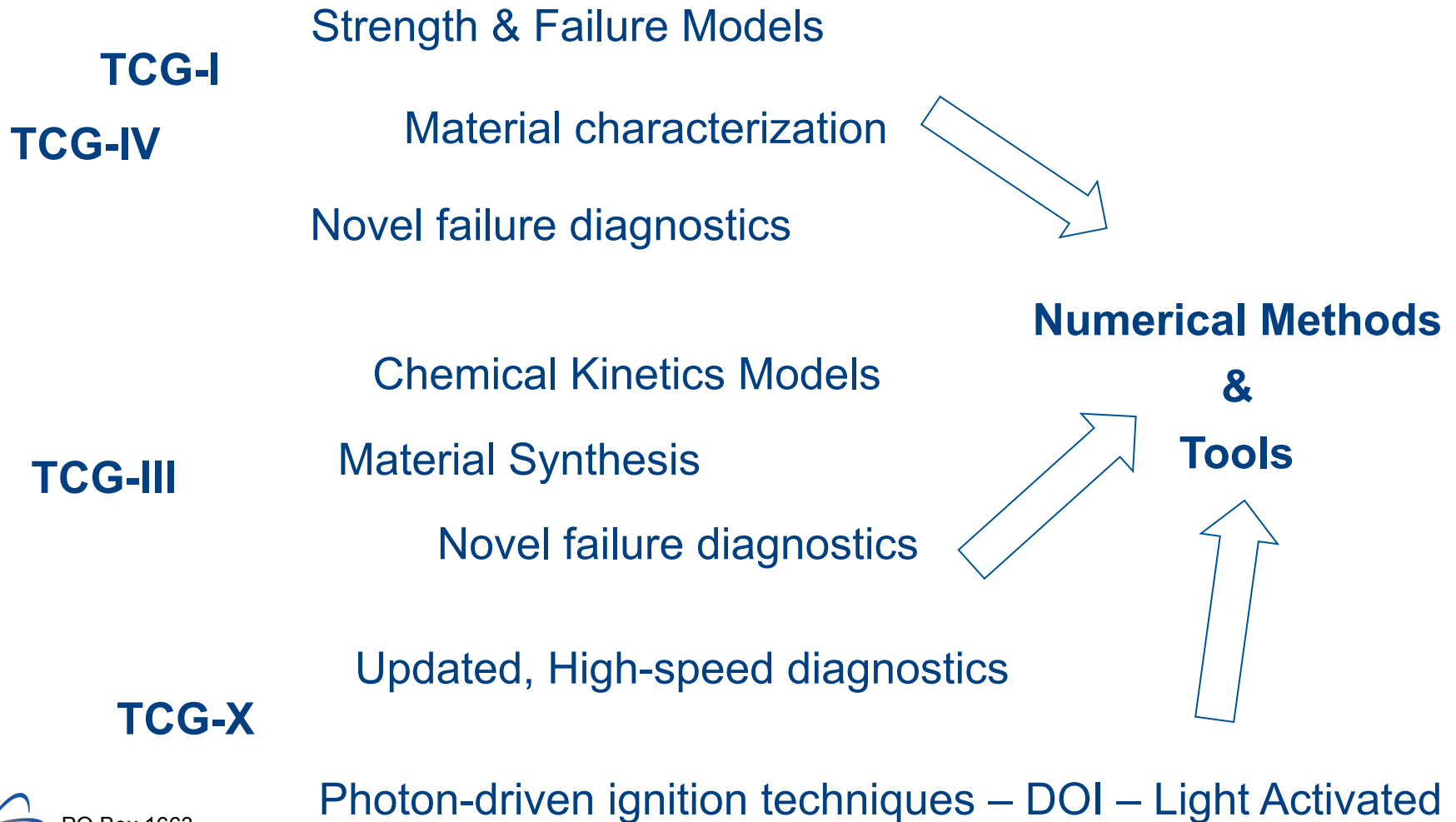
**Detonator design issues – deeper understanding of processes**

**Next generation numerical tools**

- Material Particle Method (MPM) overlaying an Eulerian grid
- 'Stable' methods to simulate localization and failure



# Integrated experimental and numerical effort





# Integrated surveillance and analysis effort

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## TCG-XIV

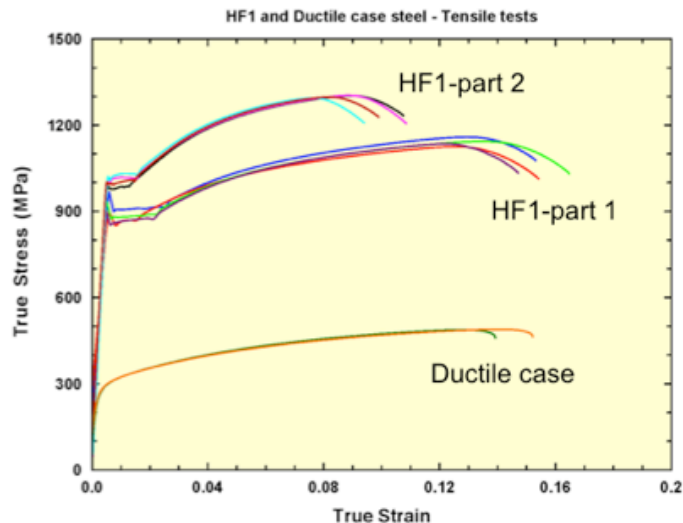
System Assessment – resource planning

Prognostics & Health Management

**Statistical Methods  
&  
Predictive Tools**



# Material Characterization Efforts under JMP



- HF-1 steel
- AISI 4140, 4340
- Lead & Solders
- Zr, U, Hf, Re
- Teflon
- Polyethylene
- Foams & adhesives
- PBXN-9
- AFX 757
- HPP ( AP/Al/HTPB)
- variety of binders

Temperature

Strain-rate

Phase

Complex material

Single phase

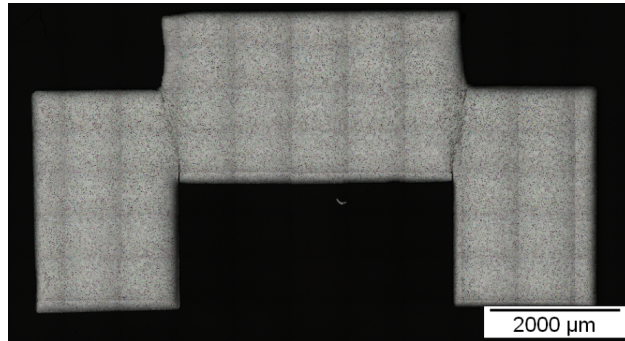
Component

UNCLASSIFIED

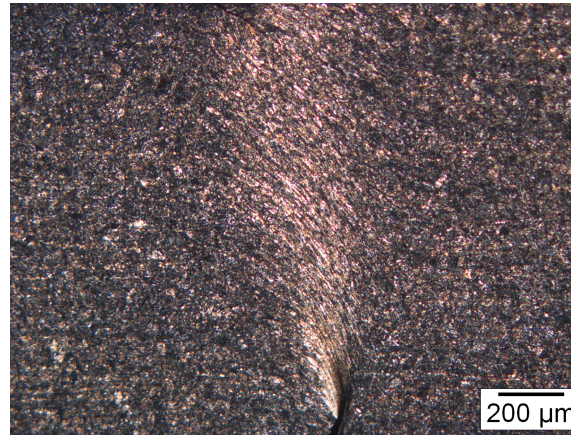


# Influence of heat-treatment on 4340 steel failure behavior – forced localization

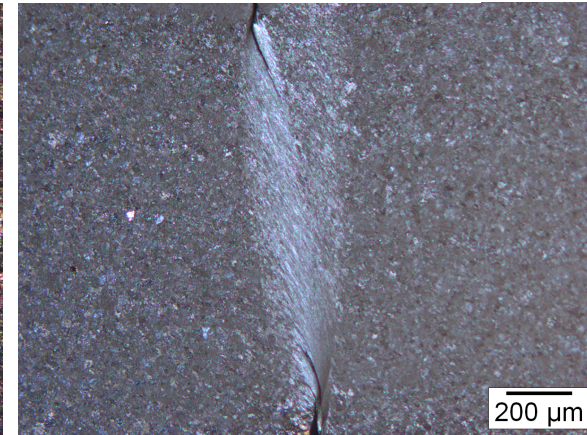
## Tested 'Tophat' geometry



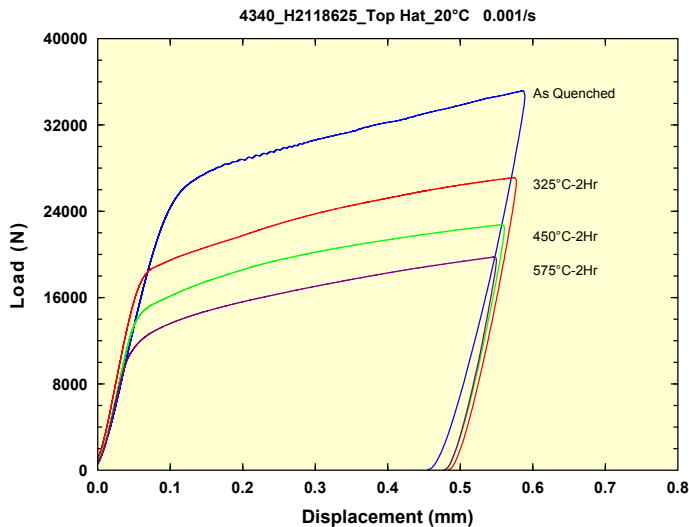
575°C-2hr (0.4777 mm disp)



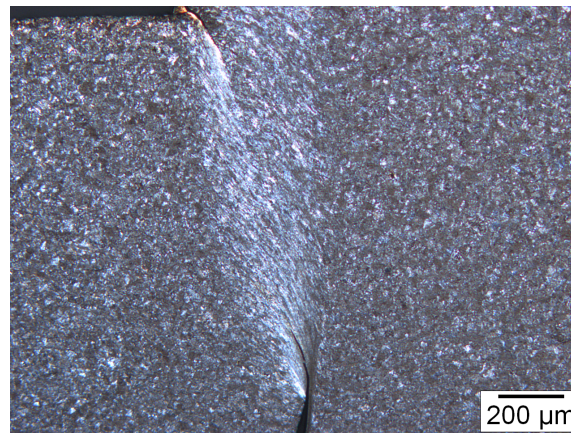
325°C-2hr (0.4953 mm disp)



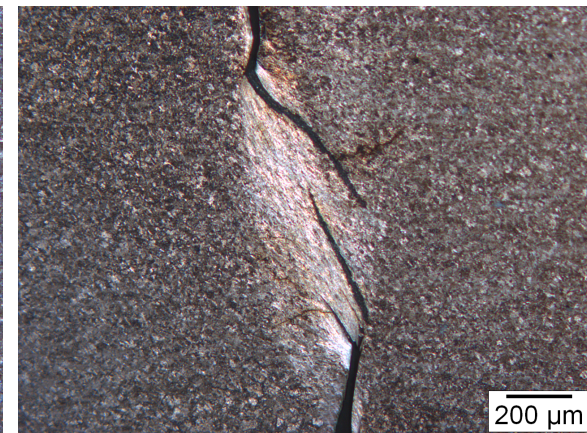
## Measured force and displacements



450°C-2hr (0.4851 mm disp)



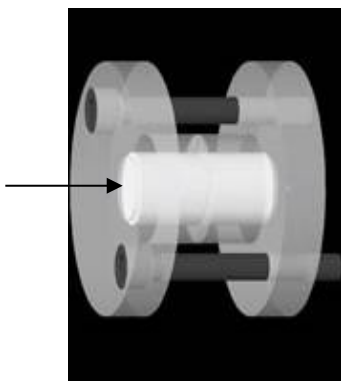
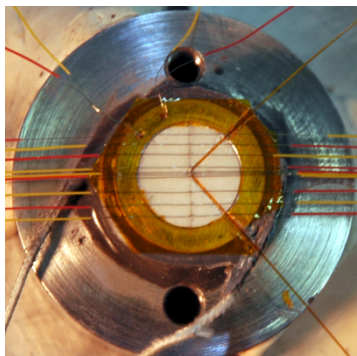
As Quench (0.4648 mm disp)



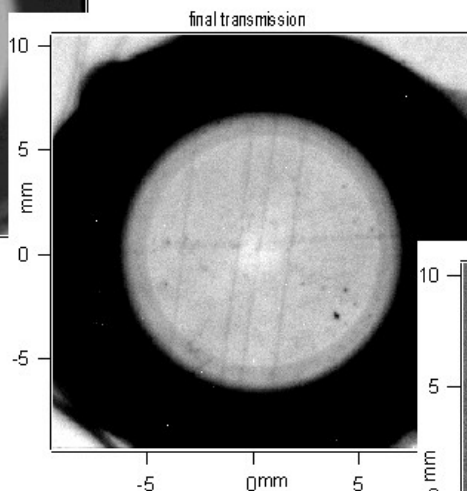
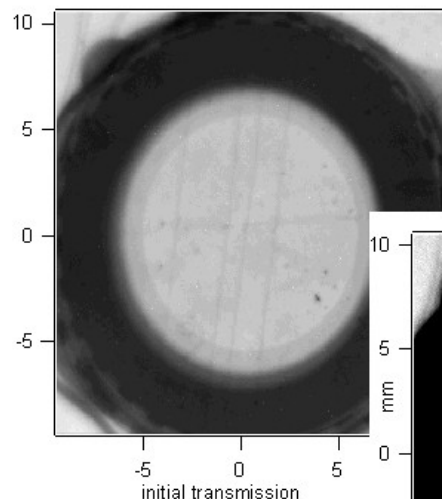
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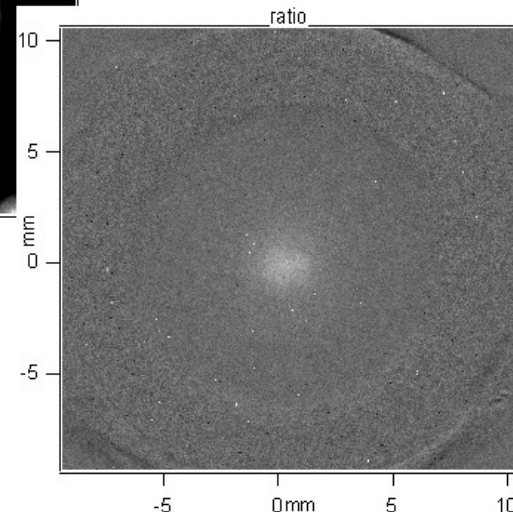
# Monitoring of confined energetic as it approaches cook-off (slow cook-off)



illumination axis



500 ms movie integration  
Ratio to background



The damage 'kernal' is different for similar high-HMX formulations

Binder plays a significant role → aging

Fast cook-off using  $\mu$ -wave heating

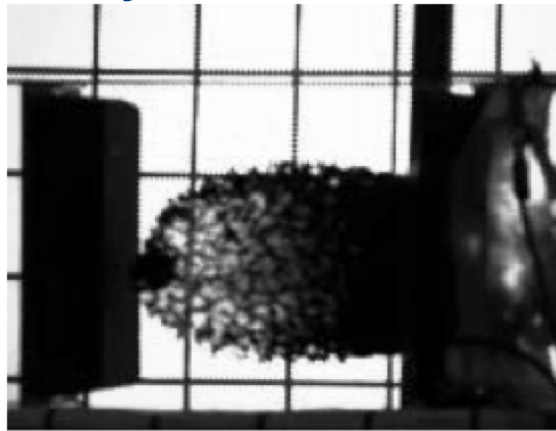
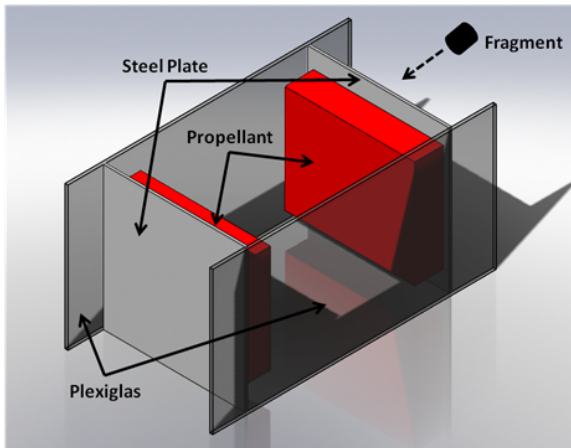


# Army Burn-to-Violent-Reaction Test (ABVR Test)

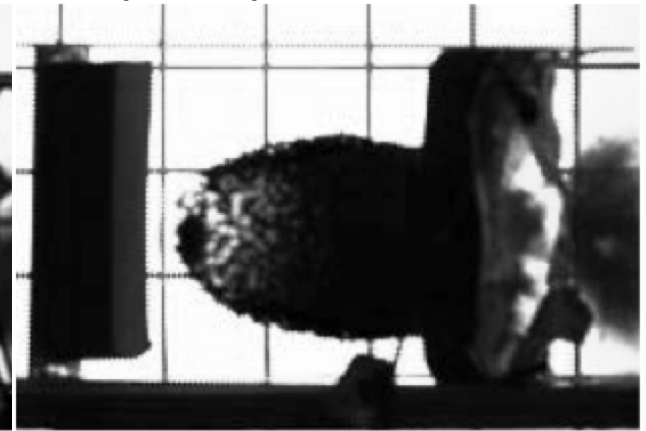
*AMRDEC executed about 100 shots*

JOINT US/UK PROJECT AGREEMENT

## Army Burn-to-Violent Reaction (ABVR) Tests



3000 ft/sec



4000 ft/sec



5000 ft/sec

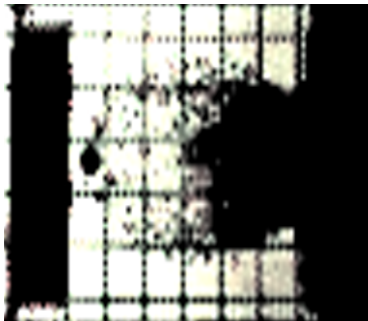


6000 ft/sec

Fragment Impact



Sphere Impact



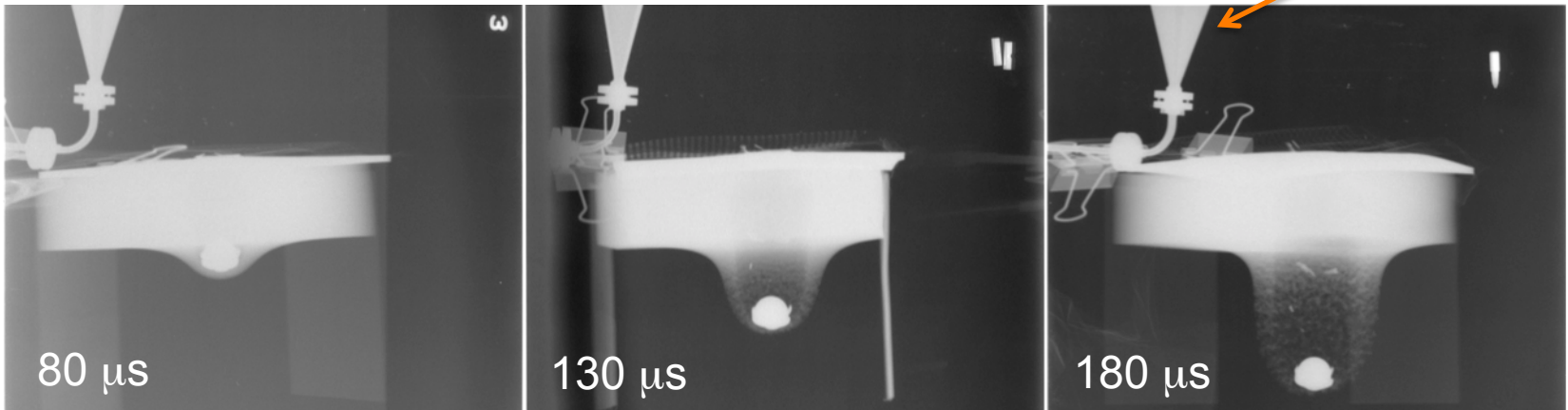


# Inert ABVR impact tests show the fragmentation processes

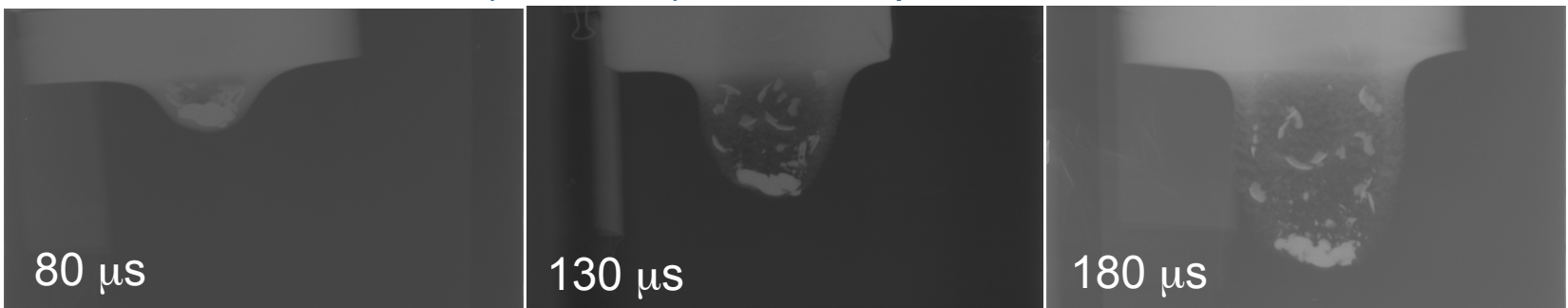
Steel ball impacts on covered mock propellant slabs

JOINT US/UK IM PA

K12-18841 969 m/s (3177 ft/s) 440C sphere HPP mock mm-wave radar horn



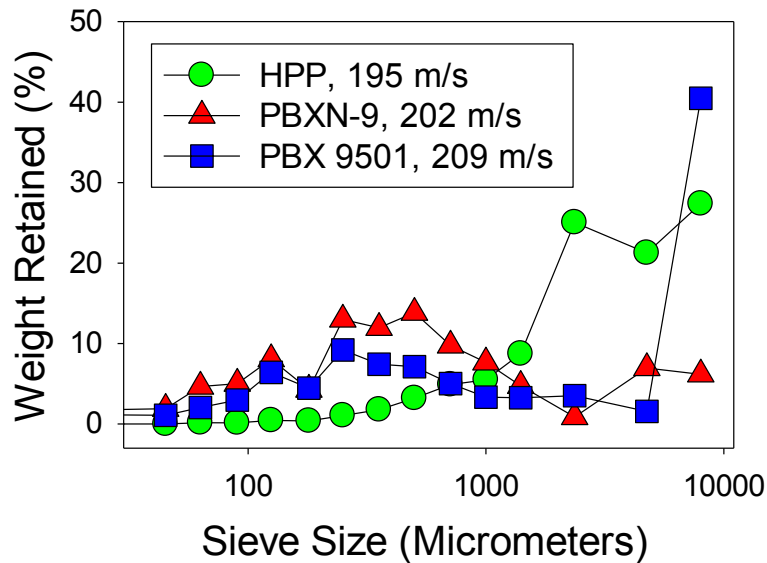
K12-18843 1344 m/s (4408 ft/s) 440C sphere HPP mock





# Friability testing of HPP Propellant

Completely different failure process due to binder selection.



This has a huge impact on our legacy modeling tools.